Ch.10 Motion & Momentum

Section 10.1What is Motion

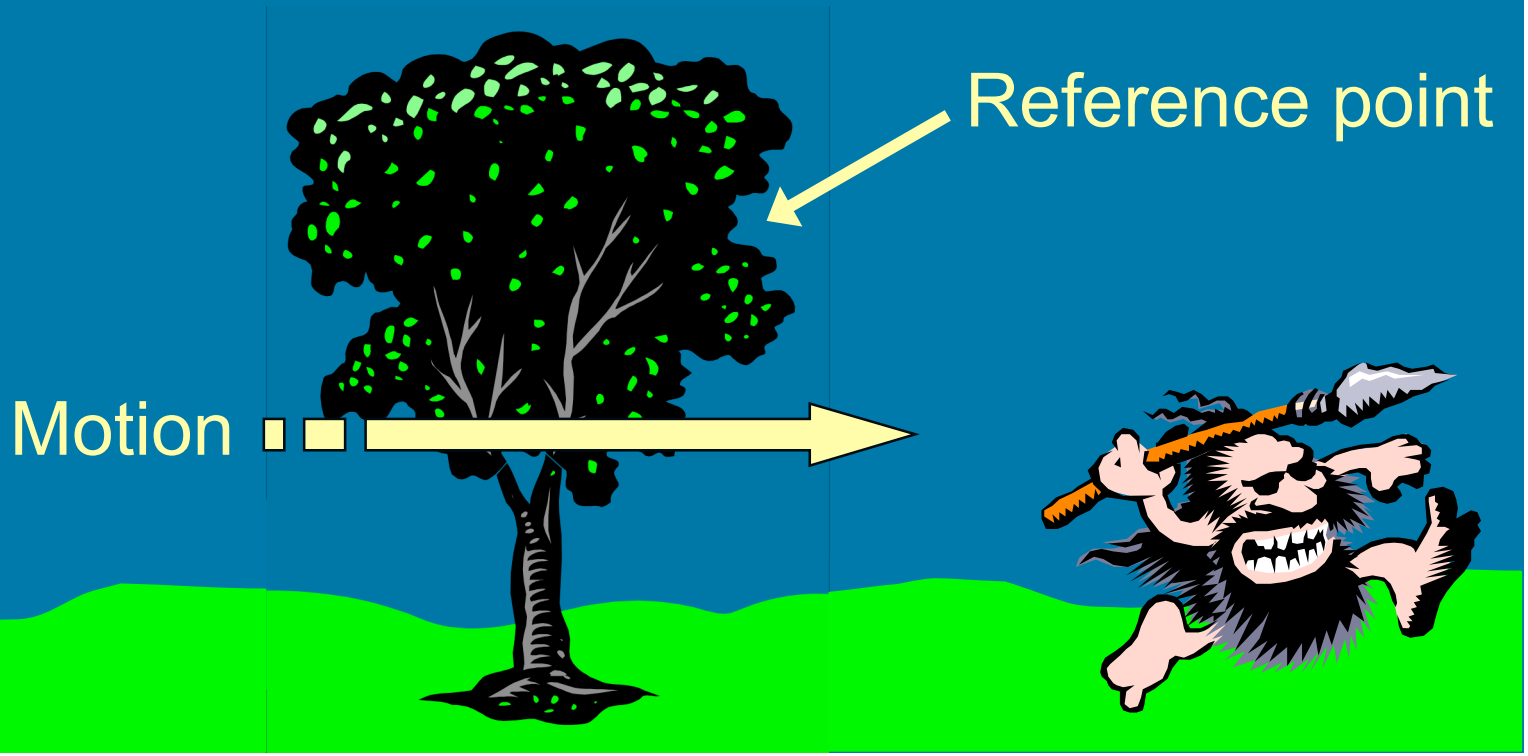
- Distance & Displacement
- Speed & Velocity
- Graphing Motion

Motion

- **Problem:**
  - Is your desk moving?
  - Reference Frame Video
- Motion is Relative
- We need a **reference point**...
  - nonmoving point from which motion is measured

Motion

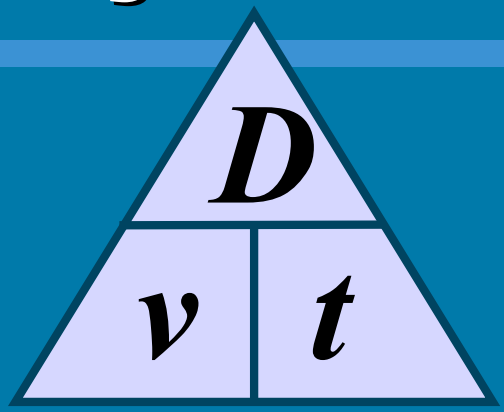
- **Motion**
  - Change in position in relation to a reference point.



Motion

- Distance vs. Displacement
- Distance: Length of route of travel
- Displacement: **Distance** and **direction** between starting point and ending point
- Measured in METERS

Speed & Velocity



- **Speed**
  - rate of motion
  - distance traveled per unit time
  - Measured in Meters/second

$$speed = \frac{distance}{time}$$

Speed & Velocity

- **Instantaneous Speed**
  - speed at a given instant
- **Average Speed**

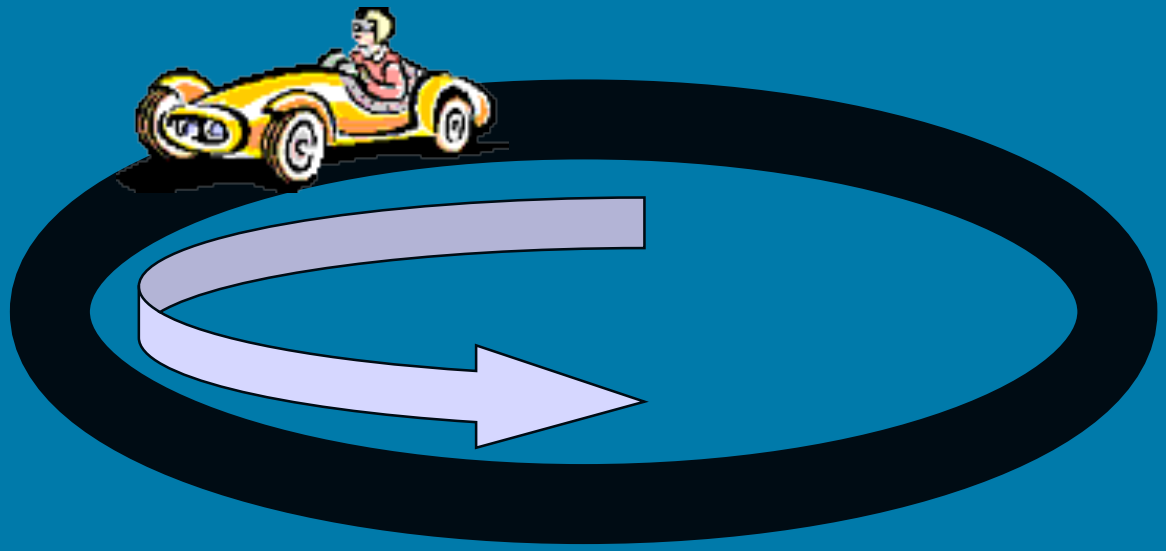
$$avg.\ speed = \frac{total\ distance}{total\ time}$$

Speed & Velocity

- **Problem:**
  - A storm is 10 km away and is moving at a speed of 60 km/h. Should you be worried?
  - It depends on the storm's direction!

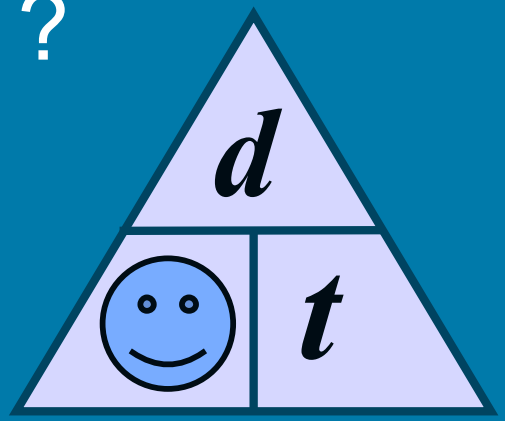
Speed & Velocity

- **Velocity**
  - speed in a given direction
  - can change even when the speed is constant!



Calculations

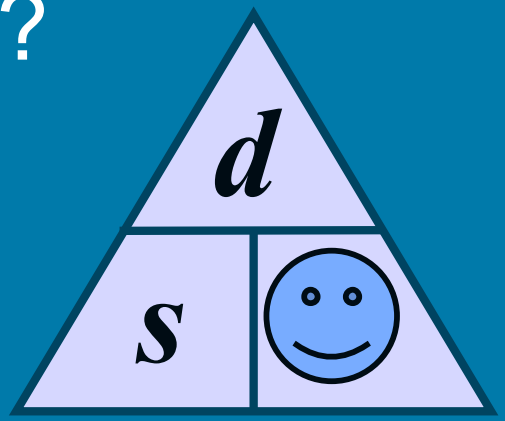
- Your neighbor skates at a speed of 4 m/s. You can skate 100 m in 20 s. Who skates faster?

GIVEN:	WORK:
d = 100 m t = 20 s s = ? 	s = d ÷ t s = (100 m) ÷ (20 s) **s = 5 m/s** **You skate faster!**

Calculations

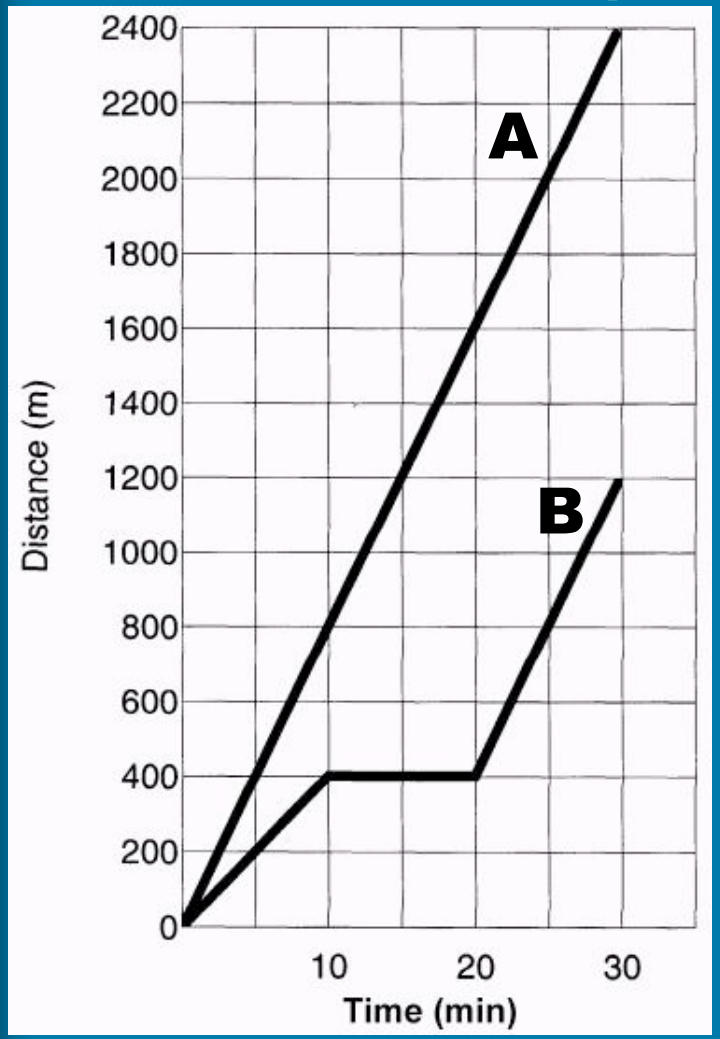
- Sound travels 330 m/s. If a lightning bolt strikes the ground 1 km away from you, how long will it take for you to hear it?

GIVEN:	WORK:
s = 330 m/s d = 1km = 1000m t = ?	t = d ÷ s t = (1000 m) ÷ (330 m/s) **t = 3.03 s**



Graphing Motion

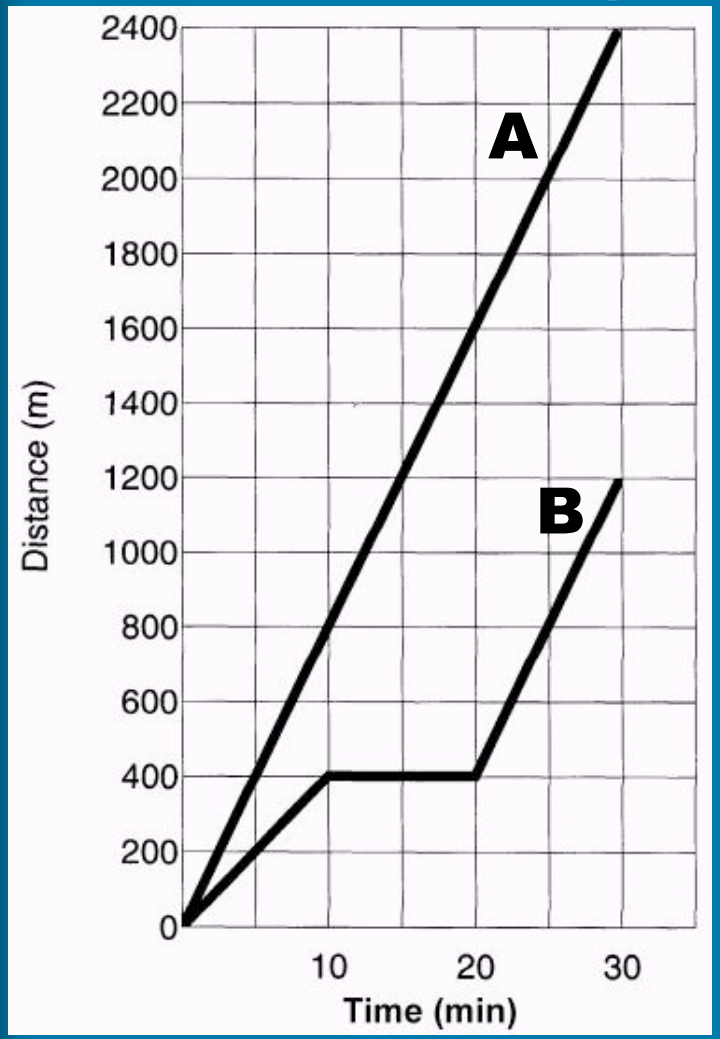
Distance-Time Graph



- slope = speed
- steeper slope = faster speed
- straight line = constant speed
- flat line = no motion

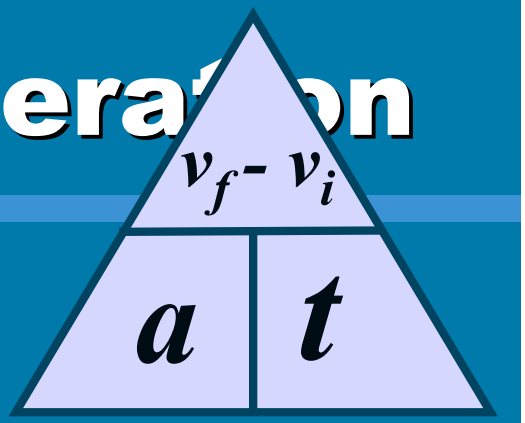
Graphing Motion

Distance-Time Graph



- Who started out faster?
  - A (steeper slope)
- Who had a constant speed?
  - A
- Describe B from 10-20 min.
  - B stopped moving
- Find their average speeds.
  - A = (2400m) ÷ (30min)
    A = 80 m/min
  - B = (1200m) ÷ (30min)
    B = 40 m/min

Section 10.2 Acceleration



- **Acceleration**
  - the rate of change of velocity
  - change in speed or direction

$$a = \frac{v_f - v_i}{t}$$

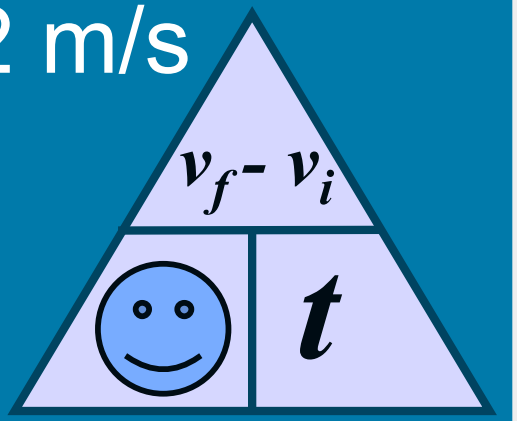
a: acceleration
v_f: final velocity
v_i: initial velocity
t: time

Acceleration

- **Positive acceleration**
  - "speeding up"
- **Negative acceleration**
  - "slowing down"

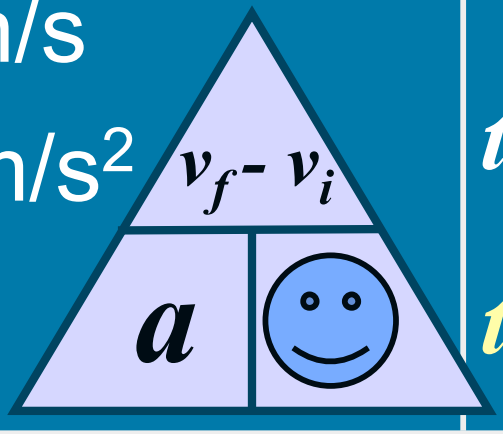
Calculations

- A roller coaster starts down a hill at 10 m/s. Three seconds later, its speed is 32 m/s. What is the roller coaster's acceleration?

GIVEN:	WORK:
v_i = 10 m/s t = 3 s v_f = 32 m/s a = ? 	$a = (v_f - v_i) \div t$ a = (32m/s - 10m/s) ÷ (3s) a = 22 m/s ÷ 3 s **a = 7.3 m/s^2**

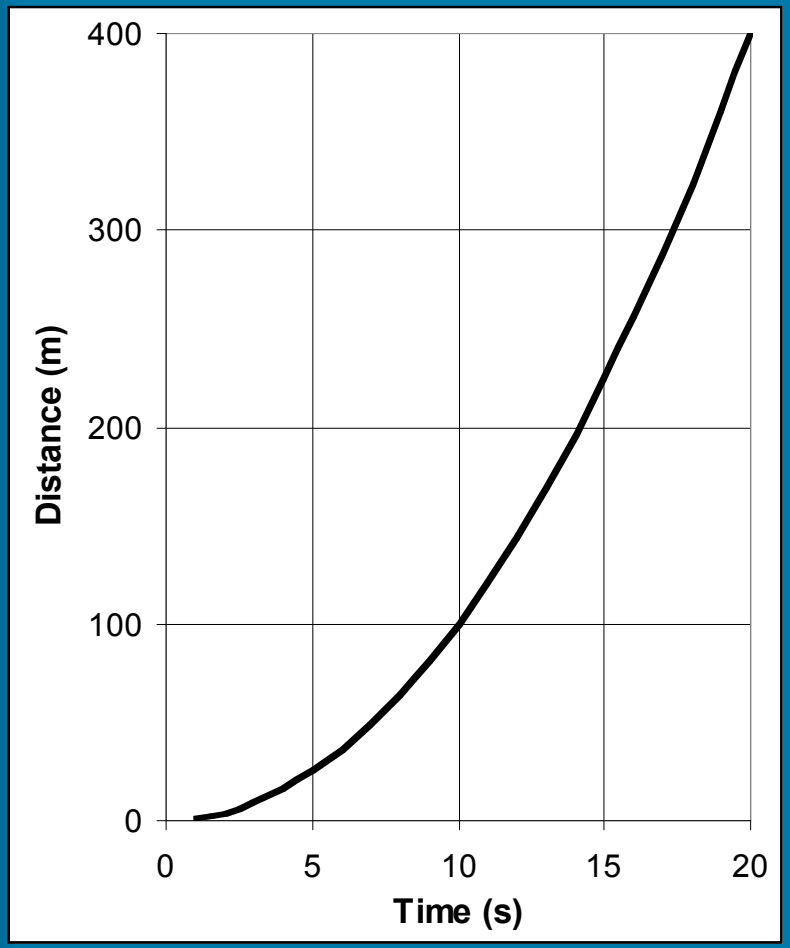
Calculations

- How long will it take a car traveling 30 m/s to come to a stop if its acceleration is -3 m/s^2?

GIVEN:	WORK:
t = ? v_i = 30 m/s v_f = 0 m/s a = -3 m/s^2 	$t = (v_f - v_i) \div a$ t = (0m/s-30m/s)÷(-3m/s^2) t = -30 m/s ÷ -3m/s^2 **t = 10 s**

Graphing Motion

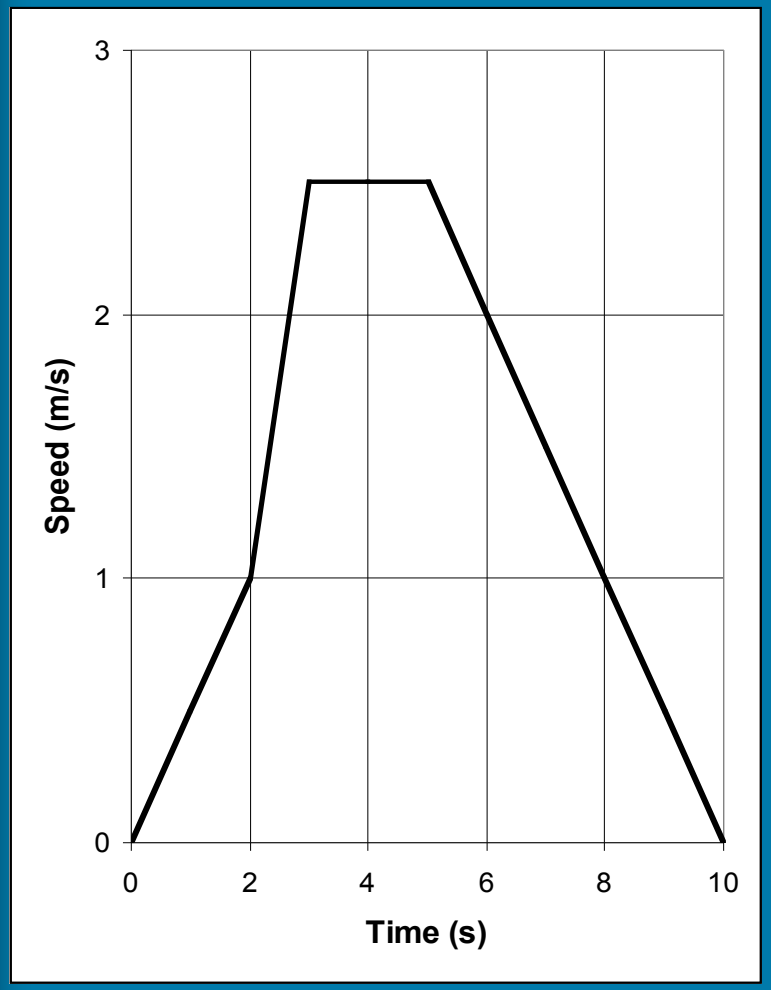
Distance-Time Graph



- Acceleration is indicated by a curve on a Distance-Time graph.
- Changing slope = changing velocity

Graphing Motion

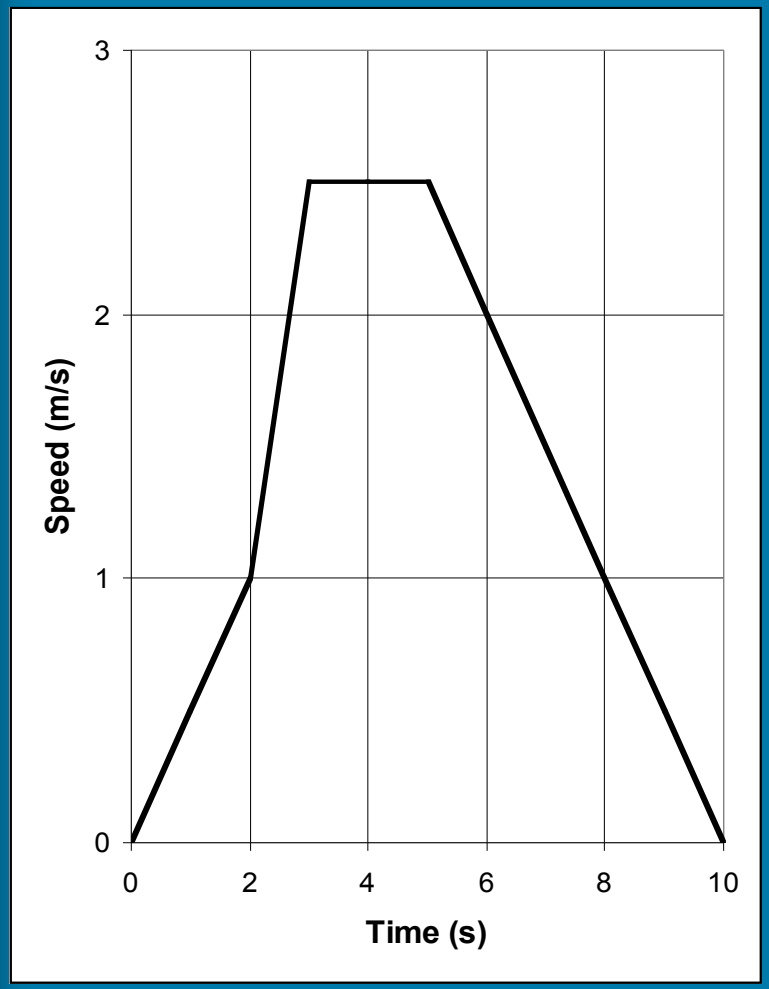
Speed-Time Graph



- slope = acceleration
  - +ve = speeds up
  - -ve = slows down
- straight line = constant accel.
- flat line = no accel. (constant velocity)

Graphing Motion

Speed-Time Graph



Specify the time period when the object was...

- slowing down
  - 5 to 10 seconds
- speeding up
  - 0 to 3 seconds
- moving at a constant speed
  - 3 to 5 seconds
- not moving
  - 0 & 10 seconds